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THE NYMPHS OF *ENALLAGMA CLAUSUM* MORSE AND *E. BOREALE* SELYS.

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In the course of a limnological study of lakes of various salt concentrations in the Province of Saskatchewan, extending over a period of three years (1938-1940), Mr. J. E. Moore made extensive collections of aquatic organisms, among which was a considerable number of Odonata, both adults and nymphs. These were sent to the writer for determination and the records of such species as could be definitely identified were reported in our preliminary list of the Odonata of Saskatchewan (Walker '40). Most of the records of Zygopterous nymphs, however, had to be omitted because of the impossibility of specific determination. These belonged to the genus *Enallagma,* which was represented in the collection of adults chiefly by three nearly related species of similar size, viz. *E. boreale, cyathigerum* and *clausum.*

Of these three species the nymph of *clausum* was undescribed, while those of *boreale* and *cyathigerum* have never been satisfactorily differentiated. Characters have been given by the writer (Walker '16) for separating them but further study of *boreale* in large series and of the single reared specimen we possess of *cyathigerum* indicate that the characters given are not reliable. Garman ('17) described the nymphs of both species, and *E. cyathigerum* has been well described and figured by various European workers, e.g., Ris ('09), Lucas ('30) and May ('33). It would appear from these sources of information that the gills of *cyathigerum* are usually shorter than those of *boreale,* less abruptly pointed, and less pigmented, being usually in fact without pigmentation. According to Garman the gills of *cyathigerum* are 5.5 mm. long and without pigmentation; according to Lucas they are 5.5-6 mm. long and have a "dark band along the nodal line, and generally a fainter one more distal and parellel to it (if not more than one)". Garman gives 7 mm. as the length of the gills of *boreale,* but our measurements range from 5.5-7. While they usually have cross-bands as described by Lucas for *cyathigerum,* they are sometimes lacking in any definite markings. It would thus seem probable that the gills of *boreale* average longer and more spatulate and that they are usually marked with one or more cross-bands, while those of *cyathigerum* are generally a little shorter than in *boreale,* less abruptly pointed and have less pigmentation. But none of these characters, nor any others described appear to be reliable for the separation of these two nearly related species in their nymphal stages, and it is quite possible that they are not separable. It is at any rate becoming increasingly evident that much more intensive studies of Zygopterous nymphs must be made before many of the closely related species can be differentiated, and there is no reason to suppose that this is necessarily possible in all cases.

In 1941 Mr. Moore reared a number of *Enallagma* nymphs from Redberry Lake, Sask., one of the more strongly saline lakes, and obtained adults of both *boreale* and *clausum* but unfortunately none of *cyathigerum.* The reared individuals were preserved in alcohol with their exuviae. We have made a detailed comparison of these exuviae, together with a number of full-grown nymphs from the same lake. We have also used in this study a large number of nymphs and exuviae of *E. boreale* from localities in Ontario. With no additional reared specimens of *E. cyathigerum* we have been obliged to omit this species from further consideration here. We can only state that *cyathigerum*

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apparently shares with *boreale* the characters in which the latter species differs from *clausum*.

Enallagma clausum Morse. Final instar of nymph.

Large and rather robust for an *Enallagma*, pale buff (probably greenish in life), with ill-defined darker blotches. Head with an angular transverse brown band across the vertex, and the hind margins somewhat darkened; femora with a faint ante-apical dusky annulus; femoral and tibial setae generally not darkened; abdomen sometimes with an indistinct paired median dorsal band and similar darkened areas above and below the lateral carinae.

Gills (fig. 1) typically with a wide dark median band, which expands just beyond the middle, forming one or two transverse blotches, of which the proximal (nodal) is the larger and is somewhat crescentic when well developed, thence narrowing distally and not reaching the apex. In the clear lateral fields of the gills the tracheae show many pigmented areas.

Head (fig. 2) of same proportions as in *E. boreale* except that the eyes are slightly less prominent. *Labium* (fig. 3) when fully retracted, just reaching the middle coxae; greatest width of mentum about five-sixths of its length, its basal width about two-sevenths of its greatest width; lateral margins proximally divergent at an angle of about 35°, the angle of divergence increasing beyond the middle, the margins here bearing 10 or 11 setae of similar size; distal margin obtusangulate with a rounded apex; mental setae 3-4; lateral setae typically 5 or 6; distal margin of *palpi* (fig. 4) with a stout ventro-lateral spine, followed by a series of 6 or 7 rounded teeth of decreasing size, the first and largest tooth usually more slender and less divergent from the second than in *E. boreale*.

Wing-cases reaching the base or middle of seg. 4.

Abdominal terga (fig. 5) rather densely clothed with minute stubby setae, which are not very regularly distributed, except along the hind margins and the lateral carinae, where they are somewhat larger. Dorsal surfaces of segs. 2-4 with dorsal patches of hair, which are shorter than in *E. boreale*. Venter of abdomen with numerous minute setae, which are chiefly on the lateral or tergal fields, except on the last four segments, where they are more generally distributed.

Gills usually a little shorter than segs. 6-10, averaging a little broader than in *boreale*, their greatest width about the middle or a little beyond; apical margins rounded with or without a small pointed tip. Lateral gills with proximal setose parts of ventral margins as in *boreale*; dorsal margins with the setae very minute (fig. 6) and confined to less than half of the length of the margin; apical fringe (fig. 1) short or absent; tracheation similar to that of *boreale*, without pigmented patches of closely branching twigs, such as occur in *E. hageni* and *ebrium*.

Ovipositor reaching a little beyond the middle of seg. 10.

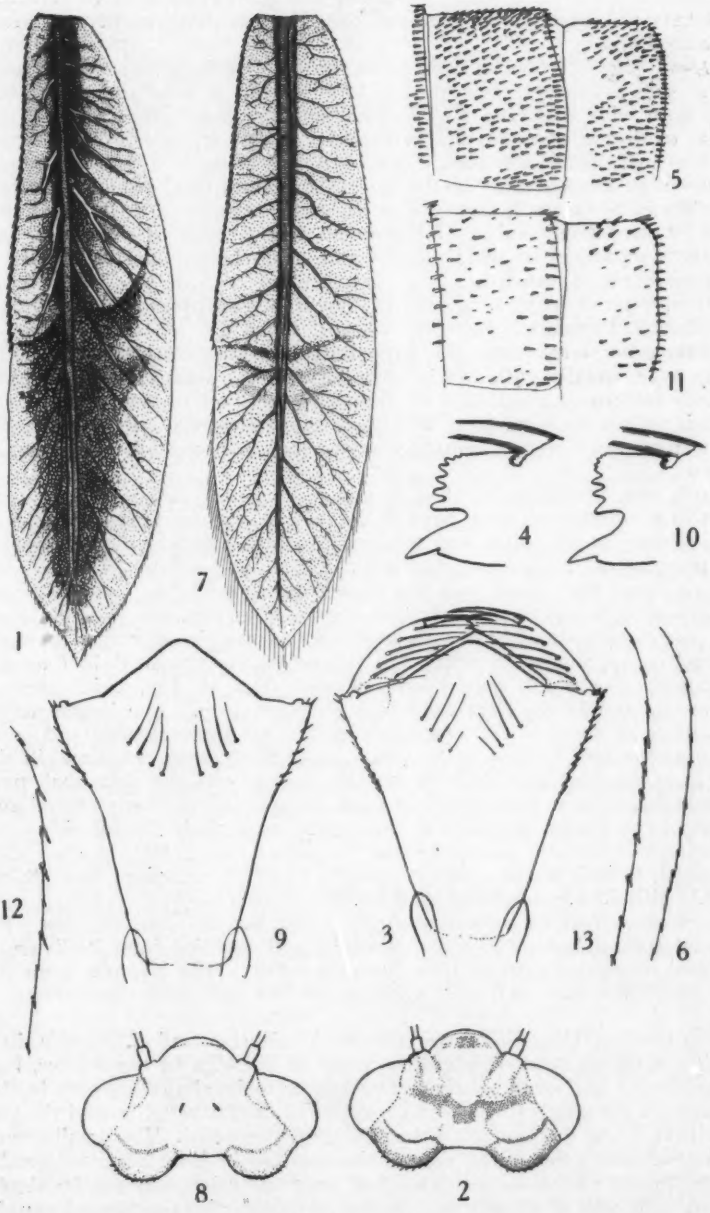
Length to base of gills (mm.), nymphs 17.7-22.5, exuviae 16-18; gills 5.5-6.0; hind femur 3.5-4.0.

Described from 6 nymphs and 11 exuviae from reared specimens; Redberry Lake, Sask. The nymphs are dated June 27 (3) and Aug. 13 (3), 1941. The dates of emerged individuals are as follows: June 7, 1 exuv. (adult missing but reared, D. S. Rawson); June 27, 5 exuv.; July 7, 1 exuv.; July 11, 1 exuv.; July 14, 1 exuv.; without date, 2 exuv.

Enallagma boreale Selys. Final instar of nymph.

Averaging a little smaller than *clausum*: usually less pigmented, the pattern often obscure, when distinct, similar to that of *clausum*. There is usually a more or less distinct dorsal longitudinal abdominal band consisting of segmentally arranged pairs of blotches separated by a pale median line, which widens posteriorly with a series of ovoidal spots. The ante-apical annuli of

PLATE XVI



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the femora are often very faint but the femoral and tibial setae are dark brown. *Gills* (fig. 7) pale or diffusely pigmented with a darker obtusangulate transverse bar a little beyond the middle and generally one or two fainter transverse bars just beyond the proximal one; tracheae with numerous interrupted pigmented areas.

Head (fig. 8) twice as wide as its median length, greatest width across the vertex; eyes moderately prominent; hind margin of head evenly convex, with many stout setae. *Labium* (fig. 9) reaching front of middle coxae, the mentum similar to that of *clausum,* but averaging a little narrower proximally, the disto-lateral margins usually feebly convex and bearing 6 or 7 larger setae, occasionally with smaller setae in the intervals; mental setae usually 4, often with a smaller fifth, rarely 3; lateral setae 6; distal margins of *palpi* (fig. 10) with a short ventro-lateral spine, followed by 5 or 6 teeth of decreasing size, the first three separated by wide notches and much larger than the others, which are indistinct and crowded.

Wing-cases reaching somewhat beyond the base of seg. 4, or barely reaching it in distended specimens.

Abdominal terga (fig. 11) irregularly and sparsely clothed with minute stubby setae, usually with nearly bare dorso-lateral areas; lateral carinae and posterior margins bearing rows of larger and more crowded setae; terga of segs. 2-4 each with a patch of hairs which are much longer than the setae. Venter with a sparse scattering of minute setae on segs. 7-10, the other segments nearly glabrous.

Gills (fig. 7) nearly as long as segs. 6-10, 3 to 5 times as long as broad, widest at a variable distance beyond the middle, the margins curving convexly to the slightly acute apices and bearing a rather long fringe of close-set hairs. Ventral margins of lateral gills sharply divided into a firm proximal part and a more membranous distal part, the former nearly straight, extending beyond the mid-length of the gill and bearing a close-set series (ca. 40) of strong appressed setae; the distal part without such setae; dorsal margin somewhat more convex proximally, not sharply divided, but having on its proximal half or more a weaker and more widely spaced series of setae (figs. 12, 13), which are variable both in size and in the distances which separate them. The largest setae may be as long as those of the ventral series but are more slender and generally not more than half as long as the spaces that follow them. Median gill slightly wider than the laterals with both margins convex and the proximal parts of both margins bearing series of 20-30 setae, somewhat irregularly spaced and not so stout nor so closely appressed as the ventral setae of the lateral gills.

Ovipositor reaching a little beyond the middle of seg. 10.

Length to base of gills (mm.), nymphs 16.0-19.5, exuviae from Snelgrove 13.0-13.5; gills 5.5-7.0; hind femora 3.5-3.75.

Numerous nymphs from Favourable Lake, Kenora District, Ont.; Pasqua Lake and Round Lake, Sask.; reared adults with exuviae from Redberry Lake, Sask.; and numerous exuviae from Snelgrove, Ont. The nymphs from Pasqua and Round Lakes may include *E. cyathigerum* but agree with the others.

The most striking difference between *E. clausum* and *E. boreale,* in most cases, is the conspicuous dark median band of the gills in the former, but the most important and constant characters appear to be the differences in the development of the setae on the dorsal margins of the lateral gills, and the general distribution of the short setae on the abdominal segments. The smaller number of well developed setae on the sides of the mentum in *boreale* as compared with *clausum* appears also to be a character of some value but may not be absolutely constant. The gills of *boreale* are usually narrower, with the ventral margins of the lateral pair proximally straighter, but the gills of both species are very variable in form, and in the length of the apical fringe of hairs, which in *clausum* may be wholly absent.

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NOTES ON CHAMBERS' COLEOPHORID TYPES IN THE MUSEUM OF COMPARATIVE ZOOLOGY, CAMBRIDGE, MASS.*

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On a recent visit to Cambridge I was permitted, through the courtesy of the Museum authorities, to examine the types of Chambers' numerous Coleophorid species deposited in this institution and to make genitalic slides of the material. This study has enabled me to clear up a number of doubts which have existed regarding the identity of certain of the species and, I hope, will put our knowledge of the group on a sounder basis than heretofore. I might preface my remarks on the individual species by stating that each so-called type was very carefully checked with Chambers' original description and in practically every case was found to agree excellently; it seems safe, therefore, to consider such types as authentic.

Of the twenty-nine Coleophorid species described by Chambers the types of six could not be discovered and must be presumed to be lost, destroyed or present in some other institution. These are *aeneusella, zelleriella, vernoniaeella, gigantella, ciliaeochrella and trilineella.* In four other cases—*albacostella, biminimaculella, fuscostrigella* and *inornatella*—the types proved to be non-Coleophorid and possibly referable to the Blastobasidae, but my lack of knowledge of many of the groups of Microlepidoptera and the poor condition of the types for study prevented me from placing them definitely. Detailed notes on the individual species follow.

Coleophora nigralineella Cham.

Coleophora nigralineella Chambers, 1876, Can. Ent., VIII, 172.
Coleophora ochrella Chambers, 1878, Bull. Geol. Surv. Terr. IV, 94 (*new synonymy*).

There are two specimens of *nigralineella* labelled 'Type', to one of which the larval case is attached; this case is not, however, a 'pistol-case' as we know it but a holster-case, very similar to that of *pruniella;* as noted in the original description there is a triangular projection—presumably a piece from the edge of the leaf—on the upperside near the mouth but, of course, this has nothing to do with the attachment, as supposed by Chambers.

Both types are without abdomens but are practically identical in coloration with the type male of *ochrella.* A slide of the genitalia of this latter shows the organ to possess the same structure as in *pruniella,* the aedeagus terminating in a long, fine spine, a further confirmation of the correctness of the above synonymy.

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The present placement of *nigralineella* in the group with strong tuft at the base of the antennae is quite erroneous; the name should be transferred to the vicinity of *pruniella* and the species recognized as the *Juglans*-feeder of this closely related complex of species.

The character on which the name is based, *viz.*, the presence of a double row of black spots on the abdomen, has no specific value as this occurs in all Coleophorids.

Coleophora multipulvella Cham.

Coleophora multipulvella Chambers, 1878, Bull. Geol. Surv. Terr. IV, 94; Walsingham, 1882, Trans. Am. Ent. Soc., X, 194 (as syn. *malivorella* Riley).

A single female 'Type', placed under *malivorella* in the Collection.

Following Walsingham the synonymy has been generally accepted, but I am not at all certain as to the correctness of this after a comparison of the type with specimens in the collection of *malivorella,* bred from apple. The Type agrees quite well with the original description and the white color of the head, patagia, pectus and ventral surface of the abdomen is rather striking; there is also considerable whitish suffusion at the base of the forewing and along costa to ½. The dark dusting of the forewing is termed by Chambers' 'dark gray' but under the binocular it appeared to me to be a rather bright brown, similar to the color of the antennal rings. The tufting at the base of the antennae was worn off but may possibly have been long; the palpi are quite short, as stated. The specimens of the true *malivorella* in the collection showed the palpi much more heavily tinged with smoky brown; the color of the primaries was also much deeper smoky, in fact almost blackish, and the annulations of the antennae less pronounced. Whether these differences will prove to be specific I cannot determine as we have no material that would fit either name.

Coleophora argentialbella Cham.

Coleophora argentialbella Chambers, 1874, Can. Ent., VI, 128.

The Type male is labelled 'No. 93, Kentucky'; there are also two other female specimens in the series labelled 'Kentucky' and the name in writing, but these are much larger and probably not the same species; they cannot be considered as types. There was no case attached to the type.

The species is a small one, about half the size of *monardella* McD. with forewings silvery-white and hindwings pale smoky; there is a faint trace of smoky color in the fringes and on the fore legs. The antennae are non-annulate and very faintly serrate, with a weak tuft at base. Palpi with second joint untufted, white.

Male Genitalia (from slide of Holotype). Gnathos globular. Sacculus gradually rounding to caudal margin without any inward tooth; caudal margin very feebly dentate and terminating in a *short,* somewhat curved apical hook. Clasper quite narrow, projecting considerably beyond apex of sacculus. Aedeagus rather broad, the lateral chitinous rods with slightly raised edges, each rod terminating in a strong, flat, triangular tooth—possibly slightly preapical on the right side. Vesica armed with a moderately large basal cornutus, followed by 4 or 5 quite small ones, more apically placed and well-separated from one another.

Coleophora rufoluteella Cham.

Coleophora rufoluteella Chambers, 1874, Can. Ent., VI, 129 ; *id.*, 1878, Can. Ent., X, 112/13; Braun, 1914, Jour. Cin. Soc. Nat. Hist., XXI, 160 (as syn. *ostryae* Clem.).

Five specimens (2 ♂, 2 ♀, 1 without abdomen) bear red type labels but are without further name-designation; they are placed under *caryaefoliella* Clem. but whether they are specimens from which the original description of *rufoluteella* was drawn up or whether they were ones bred later by Chambers from cases on hickory as mentioned in his second reference, is impossible to tell. Slides made of the genitalia of the two males show that two species are represented, the main differences occurring in the armature of the aedeagus. I have therefore

chosen as holotype a male specimen which agrees in genitalia with specimens in our collection, bred at both Bobycaygeon and Ottawa, from cases on the upper side of *Ostrya* leaves. This would bear out Dr. Braun's contention (*op. cit.*, p. 160) that *rufoluteella* Cham. should be sunk as a synonym of *ostryae* Clem. and disposes of the name in as satisfactory a way as is now possible.

Coleophora auropurpurella Cham.

Coleophora auropurpuriella Chambers, 1874, Can. Ent., VI, 130.

Of the two specimens labelled by Chambers which might possibly be considered as types all that remains is a wing apiece. As far as can be told the usual idea of the species is correct.

Coleophora cinerella Cham.

Coleophora cinerella Chambers, 1878, Bull. Geol. Surv. Terr., IV, 93.

A male specimen is labelled 'Type' and shows that the species has been quite misidentified as the birch-feeding member of the *pruniella* group. The color of the primaries is a much deeper smoky-brown than in this species and the antennae are non-annulate. The basal joints of the antennae are much denuded but there are traces of long hairs which point to a strong basal tuft in perfect specimens. The male genitalia definitely place the species in the 'pistol-case' group.

Male Genitalia (from slide of Holotype). Very similar to those of *tiliaefoliella* and other members of the group. Gnathos narrow and projected dorsad. Sacculus with inward tooth at junction of ventral and caudal margins, the caudal margin being well rounded and terminating bluntly. Clasper extremely narrow and projecting well beyond apex of sacculus from which it is separated by a narrow space. Aedeagus short, bulbous and blunt apically. Vesica with a long cluster of fine spines, placed more or less in a longitudinal row.

The species was quite unfamiliar to me but I imagine it should be placed next to *tiliaefoliella* pending receipt of more material for study.

Coleophora unicolorella Cham.

Coleophora unicolorella Chambers, 1874, Can. Ent., VI. 129; *id.*, 1878, Can. Ent., X, 111; Braun, 1914, Jour. Cin. Soc. Nat. Hist., XXI, 163; McDunnough, 1942, Can. Ent., LXXIV, 171, Pl. XIII, figs. 3 & 4.

The Holotype is a male and the characteristic claspers could be studied without making a slide. The species has been correctly identified.

Coleophora argentella Cham.

Coleophora argentialbella Chambers, 1875, Can. Ent., VII, 75 (*praeoc.*).
Coleophora argentella Chambers, 1878, Can. Ent., X, 112 (*n.n.*).

Two of the four specimens mentioned by Chambers were present as Types, labelled 'Colorado'; one of these, a male, showed the sparse dark dusting noted in the original description and I have made it the Holotype. Judging by the genitalia the species is close to *sparsipuncta* Heinr. and should be placed next it in our lists.

Male Genitalia (slide made of Holotype). Gnathos globular. Sacculus strongly chitinized, ventral margin straight, terminating in a small tooth, caudal margin at right angles to ventral margin and produced into a *broad, strongly recurved hook,* extending half way across clasper. Clasper rather narrow, jutting well beyond apex of sacculus. Aedeagus with a strong, chitinous ribbon on left side extending to apex, right side with only basal chitinization, no other armature. Vesica with a single, large, basal cornutus.

Coleophora sparsipulvella Cham.

Coleophora sparsipulvella Chambers, 1875, Cin. Quart. Jn. Sci., II, 294.

All that is left of the type is the thorax and wings on the left side.

My notes state that the forewing is dull white, faintly sprinkled with dark atoms, especially toward apex. Traces of light ochreous lines are present, the one below the fold being most prominent. Inner margin whitish. The species, which is unknown to me, appears to be close to *sparsipuncta*, but topotypical Colorado material must be secured before definite placement is possible.

Coleophora bistrigella Cham.

Coleophora bistrigella Chambers, 1875, Can. Ent., VII, 75; *id.*, 1877, Can. Ent., IX, 14; *id.*, 1878, Can. Ent., X, 112.

Seven specimens bear type labels. I have marked as Holotype a male with printed label 'Tex.' and the name, in Chambers' handwriting, and of this a slide has been made. I was permitted to retain a second male as paratype labelled 'Tex.' and with Belfrage's characteristic date label "12-8" and the name probably in Hagen's handwriting.

Male Genitalia (slide made of Holotype). Gnathos globular. Sacculus with broad, blunt, inward projection at apex of ventral margin; caudal margin almost at right angles to ventral margin, with the junction evenly rounded, terminating in 2 weak teeth; an inward angle is formed at the junction with the dorsal margin, this being produced into a broad blunt projection, extending half across clasper and armed apically with two slightly recurved teeth. Clasper short, broad, only slightly exceeding sacculus. Aedeagus trough-like, the sides furnished with parallel strips of chitin and with a minute apical tooth on each side; anellus strongly projected cephalad. Vesica unarmed.

Coleophora quadrilineella Cham.

Coleophora quadrilineella Chambers, 1878, Bull. Geol. Surv. Terr., IV, 94; Braun, 1914, Jn. Cin. Soc. Nat. Hist., XXI, 164.

The unique type is greasy and glued to a cardboard point so no adequate examination could be made. However, there is no doubt that Dr. Braun's determination of the species is accurate and I do not hesitate to accept it.

Coleophora chambersella Dyar

Coleophora artemisicolella Chambers, 1877, Bull. Geol. Surv. Terr., III, 133, 144 (*praeoc.*).
Coleophora chambersella Dyar, 1902, Bull. 52, U.S.N.M., 530.

Five specimens bear type labels; two of these are males (one with right wing missing), one a female, one with abdomen and right side wings missing and one all broken up and possibly not the same species. I have designated the most perfect male as holotype, the other male I was kindly allowed to retain. The original description is good. The male genitalia are very close to those of *dextrella* Brn., the aedeagus showing the same type of flat tooth apically on the right side as in this species. I note, however, that the caudal margin of the sacculus bends inward (cephalad) at its apex considerably more than in *dextrella* and that, in consequence, the tooth at the junction of the caudal and dorsal margins is situated well inward from the ventral margin of the clasper and not close to its edge as in *dextrella*. Furthermore the junction of the base of the aedeagus with the annelus is less sharp and rectangular, a downward curve rather than an angle being formed. For this reason, until more material is available for study, I think it wise to keep the two names apart although they should evidently be placed next each other; the maculation of the forewing is also very similar in both species.

Coleophora basistrigella Cham.

Coleophora basistrigella Chambers, 1877, Bull. Geol. Surv. Terr., III, 133; *id.*, 1878, Can. Ent., X, 112.

A male and a female are furnished with type labels, the male lacking the right forewing but otherwise in good condition. In view of Chambers' statement in 1878, I am accepting this specimen as the holotype. The brown blotches and dots mentioned in the original description appear quite characteristic.

Male Genitalia (from specimen agreeing with type). Gnathos oval. Sacculus weak, ventral margin terminating in small tooth, caudal margin short,

slightly outcurved and terminating in a small, incurved hook. Clasper chunky, projecting well beyond end of sacculus. Aedeagus very characteristic, rather short, base long and bent sharply at right angles to the remaining portion, each rod with *terminal tooth*; on the right rod there are *three upright, equidistant teeth* in the median section and on the left rod only two, the middle one lacking. Vesica unarmed.

Coleophora shaleriella Cham.

Coleophora shaleriella Chambers, 1875, Cin. Quart. Jour. Sci., II, 116; *id.*, 1878, Can. Ent., X, 110; Braun, 1914, Jour. Cin. Soc. Nat. Hist., XXI, 164.

The specimen marked as type is a female with name in Chambers' handwriting and a printed 'Ky. Cham.' label as well; it is unspread, without antennae and with only one worn palpus and as far as I could see did not look like a Coleophorid. Furthermore it did not correspond at all to Chambers' rather lengthy description. Under the circumstances I believe it will be best to consider this type to be spurious and to accept Dr. Braun's excellent characterization of the species as correct.

Coleophora fagicorticella Cham.

Coleophora fagicosticella Chambers, 1874, Can. Ent., VI, 129; Braun, 1914, Jr. Cin. Soc. Nat. Hist., XXI, 162.

Coleophora fagicorticella Chambers, 1878, Can. Ent., X, 111; McDunnough, 1940, Trans. Roy. Soc. Can., Sec. V, 65, Pl. II, fig. 4.

Of the two so-called types all that remains of one is a right hindwing and the basal portion of the abdomen; it is labelled '*fagicorticella*' in Chambers' handwriting. The other specimen is a female and appears to agree with the generally accepted idea of the species.

Coleophora lineapulvella Cham.

Coleophora lineapulvella Chambers, 1874, Can. Ent., VI, 130; *id.*, 1878, Can. Ent., X, 111; Braun, 1924, Trans. Am. Ent. Soc., XLIX, 353/4.

Two specimens bear type labels, one is greasy and without abdomen, the other is a female with right-side wings missing but otherwise in good shape; there is a third specimen, also without abdomen, labelled (probably by Hagen) *C. nigripulvella=lineapulvella'*, which seems the same. It is impossible to determine whether any of the above specimens served for Chambers' original description or whether they are the ones referred to in his 1878 article. None of them match the description particularly well but a genitalic slide made from the female bears out Dr. Braun's surmise that *amaranthella* Brn. is the same species. I hesitate to make the two names synonymous in the light of Braun's objections and must leave it to her to clear up the matter. I might point out, however, that the dark dot at the lower angle of the cell, stressed by Dr. Braun, is often not present in the female sex in our Ottawa series of specimens; also that there is a possibility of the date 'June 21' being an error for 'July 21' if the month was abbreviated to 'Ju.'.

Coleophora luteocostella Cham.

Coleophora luteocostella Chambers, 1875, Cin. Quart. Jn. Sci., II, 294.

The unique type is in very poor shape. No abdomen or palpi are present and only the larger portion of the right side forewing; this shows a smoky brown color with the costa *whitish* for a little over ½, rather than the 'yellowish ocherous' mentioned by Chambers. A very mixed series of specimens was included under this name, among them the misplaced types of *argentella*. More topotypical material will be needed in order to recognize the species.

Coleophora texanella Cham.

Coleophora texanella Chambers, 1878, Bull. Geol. Surv. Terr., IV, 93.

The unique type is a female and matches the description well. The general appearance is quite dark brownish and the two thin white lines are much obscured (as stated) by dark dusting. No slide was made.

NOTES ON SOME NORTHERN CANADIAN SIPHONAPTERA, WITH THE DESCRIPTION OF A NEW SPECIES*

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The following Canadian records of fleas occurring north of the 60th parallel have resulted from a recent study by the writer of the Siphonaptera contained in the Canadian National Collection at Ottawa. Most of the material dealt with here was collected by C. H. D. Clarke of the Bureau of Northwest Territories and Yukon Affairs, or by various officers of the Royal Canadian Mounted Police during the survey of the Thelon Game Sanctuary (1).

A new species of *Ceratophyllus* is described. Also, females of *Monopsyllus thambus* (Jordan) are recognized and described and possible synonymy with *M. bakeri* (Wagner) noted. In addition, notes on three little known species, *Megabothris groenlandicus* (Wahlgren), *Oropsylla alaskensis* (Baker) and *Malaraeus penicilliger dissimilis* Jordan are given, and certain diagnostic structures figured.

Ceratophyllus tundrensis n. sp.

Male. Frontal tubercle prominent. Vestiture of head rather extensive for a *Ceratophyllus* (fig. 1). Upper frontal row with seven setae of which the upper three border the anterior margin of the antennal groove. Lower or ocular row with three setae of which the first and third are very long. Four setae of varying lengths on the postantennal region of the head in addition to the marginal row. Posterior margin of antennal groove with a number of small hairs as shown. Labial palpus not quite reaching apex of fore coxa.

Pronotal ctenidium of about 28 spines.

Antepygidial bristles normally three of which the first and third are vestigial. Sometimes the third is lacking. Bristle II is much shorter than is usual in males of *Ceratophyllus* spp.

Tergite VIII with about twelve marginal setae dorsally, and with about three on the lateral surface. Inner surface of dorsal margin of tergite VIII bearing extensive spiculose area. Another patch of very sharp and slender spicules is located on the inner surface of the ventral margin (fig. 2). Clasper narrow and immoveable process (P) very broad. Moveable process (F) not extending much beyond P, and shaped as shown in the figure. There are a number of marginal setae of which three are long, and two of these are particularly stout and heavily pigmented. Ventral arm of sternite IX with a mid-ventral protuberance armed with about eight setae. Sternite VIII more or less rod-shaped, with two or three long apical setae and a membranous appendage.

Female. Chaetotaxy and general structure much as in male. Three well developed antepygidial bristles, of which the second is the longest.

Sternite VII broadly rounded apically, with no trace of a sinus. Head of spermatheca cylindrical and about twice as broad and twice as long as the tail (fig. 3).

Holotype male and *allotype* female from Baker Lake, Northwest Territories, August 27, 1937, ex arctic weasel, *Mustela arctica* (Merriam); No. 5544 in the Canadian National Collection, Ottawa.

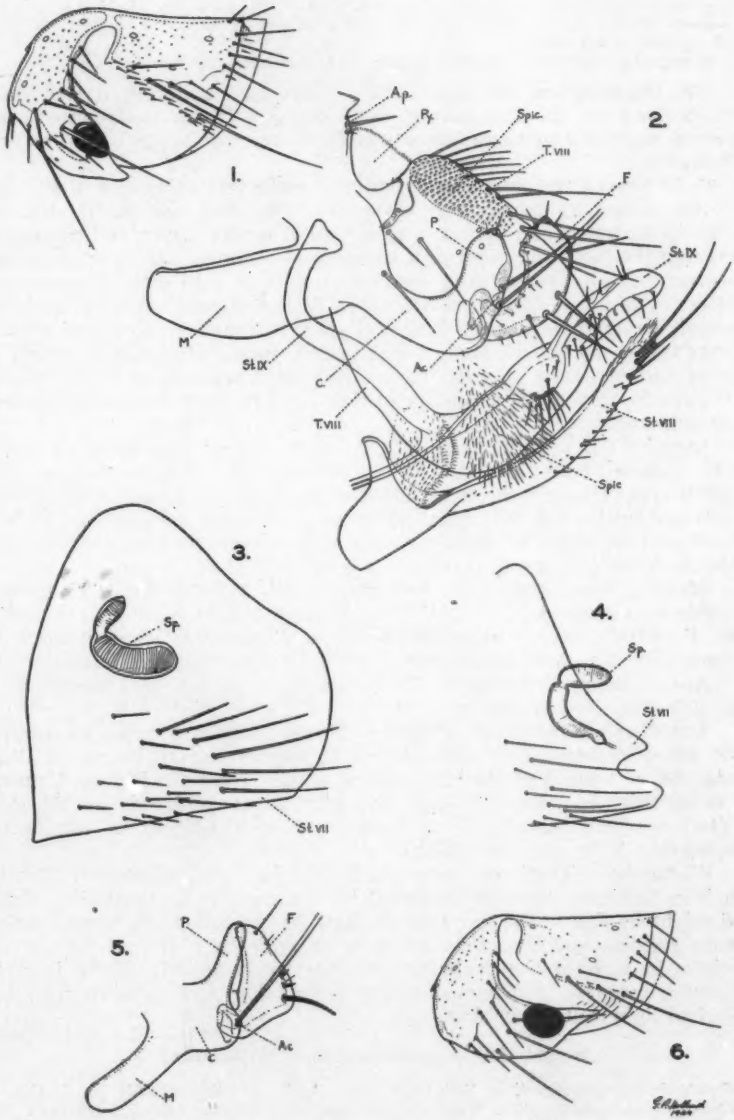
Paratypes: 1 ♂, same collection data; 1 ♂, 1 ♀ (mounted together on one slide), Hanbury Portage, Clinton, Golden Lake, N. W. T., August 22, 1936, ex marten, *Martes americana* Kerr, coll. C. H. D. Clarke; 1 ♀, same data as above.

Unfortunately, the spermathecae are missing in the two female paratypes.

As Ceratophylli are typically bird fleas, it is highly probable that the true host of the present species is some ground-inhabiting bird, such

* Contribution No. 2306, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada.

PLATE XVII



NORTHERN CANADIAN SIPHONAPTERA

as a ptarmigan or spruce grouse, which might be preyed upon by weasels and marten.

Monopsyllus thambus (Jordan)

Ceratophyllus thambus Jordan 1929, Nov. Zool. 35:36; pl. 2, fig. 21.
Ceratophyllus bakeri Wag. 1935, Mit. aus den Zoolog. Mus. in Berlin, 18(3):352.353; fig. 13. (probable synonym).
Monopsyllus thambus (Jordan). Jordan 1933, Nov. Zool. 39:78.

M. thambus was described from a single male collected at Red Deer, Alberta, ex *Lynx* sp. Its close affinity to *M. wagneri* (Bak.) was pointed out, and also it was suggested that a mouse was probably the true host. The present series confirms this.

The general structure and chaetotaxy, while very suggestive of *M. wagneri*, are even closer to *M. bakeri* (Wagner). In fact details of sternite VII and the spermatheca correspond so closely to Wagner's figure and description of *bakeri* that the latter may well be a synonym of *thambus*. In view of the considerable territory involved in the records of these fleas (the male of *thambus* from Red Deer, Alberta, a single female of *bakeri* from Killinek, Labrador, and the present small series of both sexes from Reliance, N. W. T.), no definite assertion as to the synonymy will be made at the present time. However, if *bakeri* is not identical with *thambus*, it surely cannot be more than subspecifically distinct.

Female. Frontal row usually of six or seven small setae rather than four or five as in *wagneri*.

Sternite VII with moderately deep sinus; upper lobe more or less acute (fig. 4). Spermatheca of same general vermiform shape as in *wagneri* except that the tail is approximately the same diameter as the head instead of being broader as is the case in that species. Also, chitinous thickenings are pronounced in both the head and tail regions. A constriction near the proximal end of the head of the spermatheca is similar to that in *M. wagneri ophidius* (Jordan).

Material examined: 1 ♀, Reliance, N. W. T., May 21, 1937, ex mouse, "probably *Mus musculus*", coll. W. J. G. Stewart, R.C.M.P.; 1 ♂, 2 ♀, Reliance, N. W. T., July, 1936, ex white-footed mouse, *Peromyscus maniculatus borealis* (Mearns); 2 ♂, 2 ♀, Reliance, April 15. 1944, ex *Peromyscus m. borealis*.

As the clasper of the male, with its processes, has not been previously illustrated, this structure is shown in fig. 5.

The distribution of mouse fleas in North America presents an interesting study. The three described subspecies of *M. wagneri* are all known in Western Canada. *M. w. ophidius* (Jord.) occurs at the coast, including Vancouver, and other islands. East of the Cascades it is replaced by *M. w. wagneri* (Bak.), which extends to the Rockies. East of here again, on the Great Plains, we find *M. w. systaltus* (Jord.).

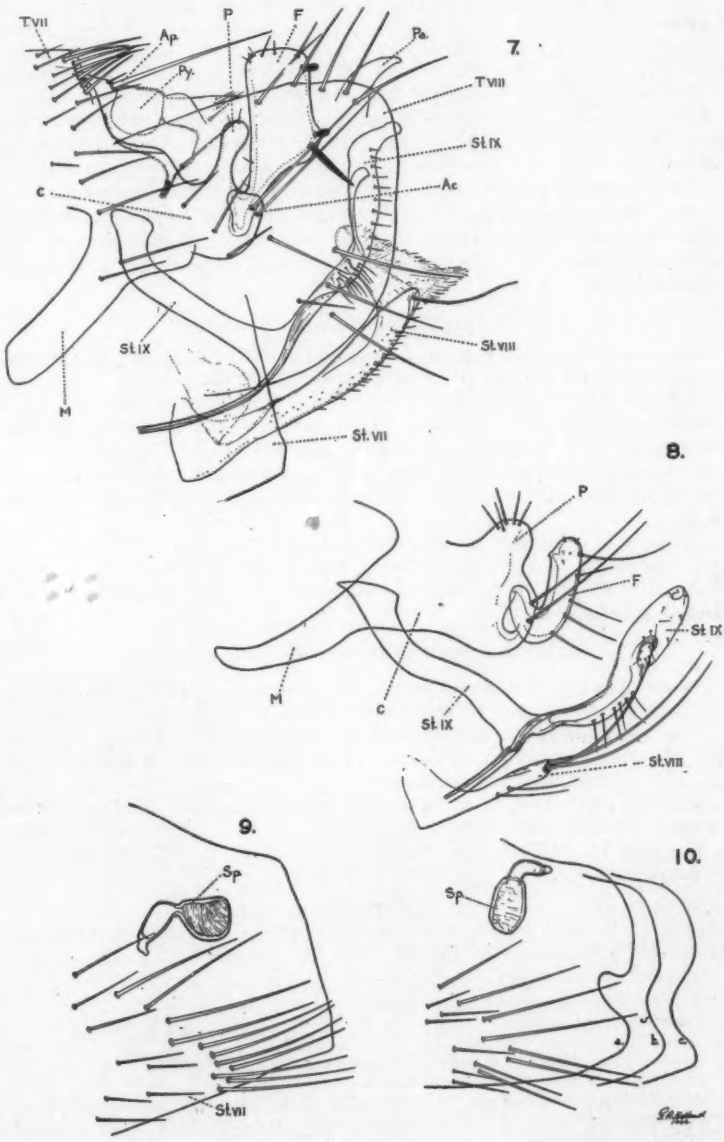
While the original specimen of *M. thambus* was collected at Red Deer, which is in territory normally occupied by *systaltus*, it seems possible that the record might be due to the fact that the host (a lynx) had migrated from more northerly regions, and that *thambus* is more typically a flea of the far north (especially in view of the probable synonymy with *bakeri*) where it replaces *Monopsyllus wagneri*. Further collections from other parts of northern Canada should shed light on this problem.

Megabothris groenlandicus (Wahlgren)

Ceratophyllus groenlandicus Wahlgren. 1903, Arkiv. för Zool. 1:183; pl. 7, figs. 1, 2.
Ceratophyllus groenlandicus Wahlgren. Jordan 1932. Fauna Arctica 6:118.
Megabothris groenlandicus (Wahlgren). Jordan 1933. Nov. Zool. 39:77.

The species was described from a single male taken at Kaiser Franz Joseph's Fjord, East Greenland, ex *Myodes torquatus* (*Dicrostonyx groenlandicus* (Traill)). As it is little known and as the published figures are somewhat inadequate, the writer presents the following supplementary description and figures of

PLATE XVIII



NORTHERN CANADIAN SIPHONAPTERA

a male flea that seems referable to this species, and which was collected at Pangnirtung, Baffin Island, ex *Lemmus trimucronatus* (Richardson) by F. McInnes.

Frontal tubercle acuminate, prominent. Chaetotaxy of head as in fig. 6. Labial palpus reaching fore trochanter.

Pronotal ctenidium of 20 spines. Metanotum with two apical spinelets on each side.

Abdominal spinelets as follows: I, 2:2; II, 4:3; III, 3:3; IV, 1:3; V, 1:1. Tergite VII with a closely packed patch of apical setae, about seven on a side. One very long antepygidial bristle, with a minute hair at its base.

Tergite VIII with five strong, dorsal, marginal setae, and about nine others disposed as in the figure (7). F about twice as long as P and shaped somewhat as in *M. abantis* (Roths.). It bears a seta at the upper angle and three heavy spine-like setae of which two are short and blunt and the remaining one, at the lower angle, long and pointed (fig. 7). Other small hairs and setae disposed as shown. Sternite VIII bears a long apical seta on each side, and a ventral row of more than twenty short setae. There is a dorsal apical appendage, with a fimbriated posterior margin.

Oropsylla alaskensis (Baker)

Ceratophyllus alaskensis Baker 1904, Proc. U. S. Nat. Mus. 27:387, 394-395, 440.
Oropsylla alaskensis (Baker) Wagner 1929, Konowia 8:313.

The species was originally described from specimens collected on *Citellus barrowensis* (*C. parryi barrowensis* (Merriam)) at Point Barrow, Alaska. The diagnosis, while adequate, did not include illustrations. As in the present collection there are several specimens which are undoubtedly of this species, the important structures of the male (fig. 8) and the female (fig. 9) genitalia are illustrated.

Material examined: 1 ♀, Thelon Game Sanctuary, N. W. T., June 24, 1937, ex *Citellus p. parryi* (Richardson), coll. C. H. D. Clarke. 1 ♂, ditto, July 18, 1937, coll. C.H.D.C. 1 ♀, Baker Lake, N. W. T., Aug. 29, 1937, ex *Citellus p. parryi*, coll. C. H. D. Clarke.

Malaraeus penicilliger dissimil's Jordan

Malaraeus penicilliger dissimilis Jordan 1938, Nov. Zool. 41:119-120, figs. 65, 66.

In the collection are three females which are apparently referable to this subspecies. As among the three there is considerable variation in the contour of sternite VII, this structure is illustrated (fig. 10) for comparison with Jordan's figure. The spermatheca is also shown.

Material examined: 1 ♀, Reliance, N. W. T., Nov. 25, 1934, ex red fox, *Vulpes fulva* (Desmarest), coll. J. Robinson, R.C.M.P. 2 ♀, Arctic Red River, N. W. T., June 17, 1937, ex fox, *Vulpes* sp., coll. Cpl. R. W. Christy. Note: The normal hosts are mice.

REFERENCE

1. Clarke, C. H. D. 1940, A Biological Investigation of the Thelon Game Sanctuary. Nat'l. Mus. Can. Bull. 96, Biol. series No. 25: 1-135; figs. 1-4; plates 1-25.

EXPLANATION OF PLATES XVII AND XVIII

Fig. 1, *Ceratophyllus tundrensis*, head of male.
Fig. 2, *Idem*, male genitalia.
Fig. 3, *Idem*, spermatheca and sternite VII of female.
Fig. 4, *Monopsyllus thambus*, spermatheca and sternite VII of female.
Fig. 5, *Idem*, clasper and processes of male.
Fig. 6, *Megabothris groenlandicus*, head of male.
Fig. 7, *M. groenlandicus*, male genitalia.
Fig. 8, *Oropsylla alaskensis*, male genitalia.
Fig. 9, *Idem*, spermatheca and sternite VII of female.
Fig. 10, *Malaraeus penicilliger dissimilis*, spermatheca, and variations of sternite VII.

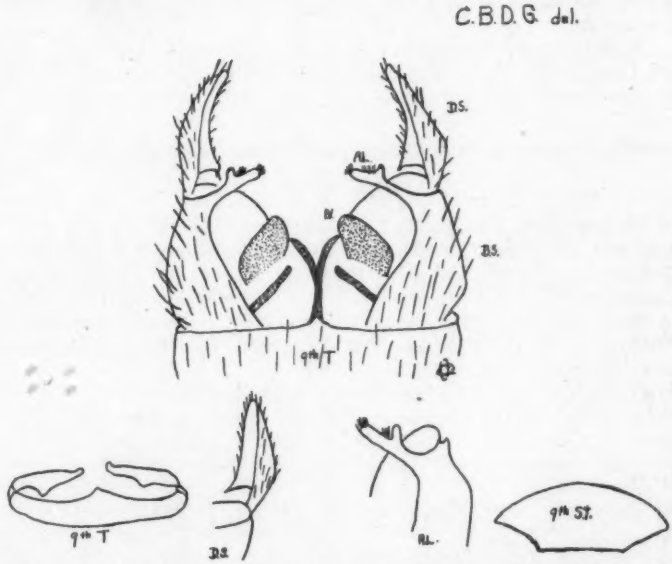
Ac, acetabular bristles; Ap, antepygidial bristles; C, clasper; F, moveable process of clasper; M, manubrium; P, immoveable process; Pa, paramere; Sp, spermatheca; Spic., spiculose area; St., abdominal sternite; T., abdominal tergite.

CHECK LIST OF DIXIDAE OF THE WORLD

BY J. L. COOPER AND W. F. RAPP, JR.,

Newark, New Jersey

In compiling this check list, *Dixa montana* Brunetti and *Dixa montana* Garrett were found to be homonyms. With the permission of Mr. C. B. D. Garrett, *D. montana* Garrett is being changed to *D. garretti* to comply with Article 34 of the International Code of Zoological Nomenclature. The authors had no opportunity to study the types, but it did not seem correct to publish a check list containing a homonym. Therefore, Mr. Garrett's description and drawing (fig. 1) of the species were utilized. Because of the inaccessibility of the description it is quoted here in its entirety:



Dixa garretti n. n. DS, distal style. AL, apical lobe. 9th T, ninth tergite. 9th St, ninth sternite. IV, interior valve. (After Garrett).

Dixa garretti n. n.

"We now enter upon the species Montanus, Lobatus, Brevis, Johannseni, Fraterna, Rudis and Parvus, a group of species in which the yellow of the dorsum of the thorax is so sordid, dirty or dull that the vitta are hard to see, though usually quite plain in certain lights. The darkest of any species could easily key to Fusca, about whose Hypopygium I know nothing.

"These species are all in group two, which has the following:

"Segment one of the flagellum rather short, and curved sides, usually a tuft of shortish bristly hairs on the sternopleura; scutellum with a row of bristles along the rim and at the center two or three set at right angles to the rim row; the base of M is much stronger, and M is usually pilose to near its base. One general color description will cover them all, as follows: The entire insect very dark appearing blackish; the yellow of the thorax hard to see but fairly plain in some segments; pleura paler reddish brown in parts; legs red yellow; wings hyaline, veins dark, usually all very hairy, and with or without duskyness round the RM cross vein, M usually pilose to near the base.

DETAILS OF D. MONTANUS

"The yellow between the vitta is the plainest of the group, the humerus is quite yellowish and the lateral edges of the dorsum are red brown; scutellum red yellow, rather sordid, so that there is no contrast to the dorsum of the thorax; the rim is set with a row of bristly hairs, and at the center are two below these; flagellum one is medium long, and very slightly swollen; the sternopleura has one or two bristly hairs about the middle of the dorsal ¼; the claws are large, all equal and bristly below; vein M pilose distally from the RM cross vein; the hypopygium is something like that of Similis, but the apical lobe is much longer and seems chitinised, with a triangular point about midway which may be the darkness of the chitin against a lighter piece. The disistyle is hollowed on the inner side, rather spoon shaped, and tapering to a point at the tip the ventral view is triangular.

"Holotype, male, Cranbrook, B. C., June 30; Allotype, female, July 13, Cranbrook, B. C.; Paratypes, two males, from Cranbrook, B. C., run to this species, but may be a new one, being taken in October.—C. Garrett."*

The following check list is believed correct up to January 1, 1944.

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aestivalis Meigen, Syst. Beschr., Vol. 1, (1818), p. 38.
England, Belgium, Germany, Morocco, Yugoslavia.

aliciae Johannsen, Psyche, Vol. 31, (1924), p. 45.
California.

amphibia De Geer, Mem. Hist. Ins., Vol. 6, (1776), p. 380; (*aquilonaris* Bergoth, Medd. Soc. Fauna Fennica, Vol. 15, (1889), p. 164); (*fuliginosa* Walker in Curtis, Brit. Ent., (1832), p. 409).
England, Germany, Finland, Belgium, Bulgaria.

andeana Lane, Rev. de Entomologia, Vol. 13, (1942), p. 94.
Peru.

arge Dyar and Shannon, Insec. Inscit., Vol. 12, (1924), p. 199.
Washington.

argentina Alexander, Ent. News, Vol. 31, (1920), p. 294.
Argentina.

atra Lane, Rev. de Entomologia, Vol. 13, (1942), p. 93.
Panama.

atrovittata Edwards, Dipt. Patgonia, Vol 2 (3), (1930), p. 105.
Chile, Patagonia.

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Greece.

autumnalis Meigen, Syst. Beschr., Vol. 7, (1838), p. 38.
Germany, Great Britain, Belgium.

bicolor Wood, Entomologist (London), Vol. 66, (1933), p. 156.
South Africa.

bifasciata Brunetti, Rec. Ind. Mus., Vol. 4, (1911), p. 269.
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binotata Edwards, Journ. M. S. Mus., Vol. 8, (1919), p. 9.
Sumatra.

bistriata Brunetti, Rec. Ind. Mus., Vol. 4, (1911), p. 268.
Eastern Himalayas.

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camerounensis Alexander, Insec. Inscit., Vol. 14, (1926), p. 10.
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campbelli Alexander, Insec. Inscit., Vol. 10, (1922), p. 20.
New Zealand: South Island.
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chapadensis Lane, Bol. Biol. Sao Paulo (n.s.), Vol. 4, (1939), p. 99.
Brazil.
chilensis Alexander, Ent. News, Vol. 24 (1913), p. 176.
Chile, Patagonia.
claripennis Seguy, Mem. Mus. H. N. Paris (n.s.), Vol. 8, (1938), p. 322.
Kenya.
clavata Loew, Cent. Vol. VIII, p. 1; Berl. Ent. Zeit. Vol. 13, (1869), p. 2.
Maine, Massachusetts, New York.
clavulus Williston, Trans. Ent. Soc. London, (1896), p. 298.
West Indies: St. Vincent. New York.
cornuta Johannsen, Psyche, Vol. 30, (1923), p. 55.
Maine, New York.
dilatata Strobl, Wien. Ent. Zeit., Vol. 19, (1900), p. 174.
Germany, Great Britain.
distincta Garrett, Sixty-one New Diptera, (1925), p. 12.
British Columbia.
dorsalis Garrett, New Amer. Dixidae, (1924), p. 4.
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dyari Garrett, New Amer. Dixidae, (1924), p. 3.
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England, Yugoslavia.
flavicollis Tonnoir, Proc. R. Soc. Tasm. (1924), p. 60.
Victoria.
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fuscinervis Tonnoir, Rec. Canterbury Mus. Vol. 2, (1924), pp. 229, 233.
New Zealand: South Island.
fuscifrons Edwards, Encyc. Ent. Dipt. Vol. 4, (1928), p. 168.
Corsica.
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France.
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China.

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California.

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British Columbia.

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Africa.

laeta Loew, Stettin Ent. Zeit., Vol. 10, (1849), p. 344.
Belgium, England.

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Panama.

lobata Garrett, New Amer. Dixidae, (1924), p. 7.
British Columbia.

lunata Edwards, Entomologist, Vol. 62, (1929), p. 160.
Africa.

maculata Meigen, Syst. Beschr., Vol. 1, (1818), p. 219.
Belgium, England, Germany, Morocco.

maculipennis Brunetti, Rec. Ind. Mus., Vol. 4, (1911), p. 266.
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marginata Loew, Cent., Vol. III, p. 1; Berl. Ent. Zeitschr., Vol., 7, (1863), p. 2.
District of Columbia.

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Maryland, Virginia.

nebulosa Meigen, Syst. Beschr., Vol. 6, (1830), p. 293.
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British Columbia, Montana.

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New Zealand.
nicholsoni Tonnoir, Proc. R. Soc. Tasm., (1924), p. 64.
Wales.
nigra Staeger, Kroger's Nat. Tidskr., Vol. 3, (1840), p. 57.
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nitida Edwards, Dipt. Patagonia, Vol. 2, (1930), p. 102.
Chile, Patagonia.
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Florida.
notata Loew, Cent. Vol. III, p. 4; Berl. Ent. Zeit., Vol. 7, (1863), p. 4.
Maryland, New Jersey.
nova Walker, List Dipt. Brit. Mus. Vol. 1, (1848), p. 85; (*centralis* Loew, Cent. Vol. III, p. 3; Berl. Ent. Zeit., Vol. 7, (1863), p. 3.)
Maine, New York.
nubilipennis Curtis, Brit. Ent., (1832), p. 499.
Germany, Great Britain.
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Finland, Germany, Russia.
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ochrilineata Brunetti, Rec. Ind. Mus., Vol. 4, (1911), p. 267.
Eastern Himalayas.
otagensis Alexander, Insec. Inscit., Vol. 10, (1922), p. 147.
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perexilis Seguy, Bull. Soc. Ent. France, (1928), p. 45.
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peruviana Edwards, Ann. and Mag. Nat. Hist., Vol. 7, (1931), p. 261.
Peru.
philpotti Tonnoir, Rec. Canterbury Mus., Vol. 2, (1924), p. 227.
New Zealand.
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British Columbia.
puberula Loew, Stettin Ent. Zeit., Vol. 10, (1849), p. 341.
Belgium, England, Germany.
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France.
rhathyme Dyar and Shannon, Insec. Inscit., Vol. 12, (1924), p. 197.
Washington.
rostrata Edward, J. F. M. S. Mus., Vol. 17, (1933), p. 250.
Borneo.
rudis Garrett, New Amer. Dixidae, (1924), p. 6.
British Columbia.
septentrionalis Tonnoir, Rec. Canterbury Mus. Vol. 2, (1924), p. 226.
New Zealand.
serotina Wiedemann, in Meigen, Syst. Beschr. Vol. 1, (1818), p. 217.
Belgium, Finland, Morocco.
serrata Garrett, New Amer. Dixidae, (1924), p. 2.
British Columbia.
serrifera Edwards, Encycl. Ent. Dipt., Vol. 4, (1928), p. 169.
Corsica.
shannoni Lane, Rev. de Entomologia, Vol. 13, (1924), p. 88.
Costa Rica.
similis Johannsen, Psyche, Vol. 30, (1923), p. 57.
New York.
simplex Garrett, Sixty-one New Dipt., (1925), p. 12.
British Columbia.

somnolenta Dyar and Shannon, Insec. Inscit., Vol. 12, (1924), p. 195.
Idaho, Alaska.
submaculata Edwards, Ent. Mo. Mag., (3), Vol. 6, (1920), p. 269.
Belgium, England, Germany, Corsica.
tetrica Peus, Ent. Berlin, Vol. 1, (1934), p. 198.
Canary Islands.
tasmaniensis Tonnoir, Proc. R. Soc. Tasm., (1923), p. 63.
Tasmania.
terna Lowe, Cent., Vol. III, p. 2; Berl. Ent. Zeitschr. Vol. 7, (1863), p. 3.
New York.
thones Dyar and Shannon, Insec. Inscit., Vol. 12, (1924), p. 193.
Washington.
torrentia Lane, Bol. Biol. Sao Paulo (N.S.), Vol. 4, (1939), p. 101.
Brazil.
unipunctata Tonnoir, Proc. R. Soc. Tasm., (1923), p. 66.
Tasmania.
universitatis Cockerell, Proc. Ent. Soc. Washington, Vol. 28, (1926), p. 166.
Colorado.
varipes Edwards, Ann. Mag. N. H. (10), Vol. 14, (1934), p. 325.
Guinea.
venezuelensis Lane, Rev. de Entomologia, Vol. 13, (1942), p. 91.
Venezuela, Costa Rica.
venosa Loew, Cent., Vol. X, p. 1; Berl. Ent. Zeit., Vol. 16, (1872), p. 50.
Texas.
xavia Dyar and Shannon, Insec. Inscit., Vol. 12, (1924), p. 195.
California.
zeylanica Senior-White, Spolia Zeylanica, Vol. 12, (1924), p. 381.
India.

Neodixa Tonnoir

minuta Tonnoir, Rec. Canterbury Mus. Vol. 2, (1924), p. 230.
New Zealand.

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